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Soil Survey
of
Saline County, Nebraska

By

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Bureau of Chemistry and Soils

In cooperation with the
University of Nebraska, State Soil Survey Department
of the Conservation and Survey Division

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SOIL SURVEY OF SALINE COUNTY, NEBRASKA

By F. A. HAYES, in Charge, and R. C. ROBERTS, United States Department of Agriculture, and E. A. NIESCHMIDT, Nebraska Soil Survey

COUNTY SURVEYED

Saline County is in southeastern Nebraska in the second tier of counties north of the Kansas State line. (Fig. 1.) Wilber, the county seat, near the middle of the eastern boundary of the county, is about 30 miles southwest of Lincoln. The county is almost square, each boundary being about 24 miles long. It comprises 573 square miles, or 366,720 acres.

The area included in Saline County is part of a broad nearly level or rolling, in places hilly, plain sloping gradually from west to east. This plain was formerly very smooth and mantled with loess, a buff-colored silt deposit of varying thickness, but in Saline County parts of the old loessial mantle have been removed. In numerous valleys, especially in the southern and eastern parts of the county, erosion has removed the loessial material, exposing an underlying glacial drift on the valley sides, and has produced a strongly rolling or hilly land surface.

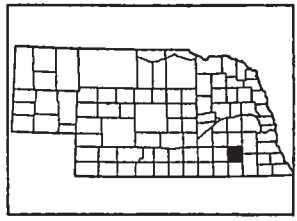

FIGURE 1.—Sketch map showing location of Saline County, Nebr.

About 85 per cent of the area of Saline County is upland, and the remainder, which includes the alluvial lands, consists of broad shallow valleys along the larger streams and their main tributaries. The larger valleys are those of Big Blue River, which flows across the eastern part of the county from north to south, and those of Turkey and Swan Creeks both of which flow in a general southeasterly direction across the northern and southern parts of the county, respectively. About 90 per cent of the upland area still retains a loessial mantle of varying thickness.

Throughout the northern half of the county, the drainage pattern is not intricate and the loess mantle has been only slightly modified by erosion. The surface of the uplands is at about the same elevation as that of the old constructional plain and is very even, except in comparatively narrow strips along both sides of Big Blue River, Turkey Creek, and the larger tributaries of these streams, where surface run-off is rapid and erosion has created a strongly rolling relief. In the less rolling parts of the county, drainage, although slow, is fairly well established, except in scattered basinlike depressions throughout the more nearly level sections where water accumulates after periods of precipitation and remains on the surface of the ground for a period ranging from a few days to several weeks.

The terraces are most extensive along Big Blue River, occurring in wide almost continuous bodies on both sides of this stream throughout its course across the county. Elsewhere the terrace developments occur in comparatively narrow broken strips. All terraces are well

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above overflow and have nearly level unbroken surfaces except where intrenched by shallow steep-sided drainage channels issuing from the uplands. The elevation of the terraces ranges from 5 to 40 feet above the adjoining flood plains and most of the slopes to the flood plains are short and steep. The higher terraces are between Wilber and De Witt on the east side of Big Blue River.

Throughout the southern half of the county the surface of the uplands is more uneven than in the northern half and in places is very hilly, especially in the Swan Creek drainage basin in the southwestern part where an intricate dendritic drainage system has removed most of the loessial mantle. Even in this locality, however, most of the hill and ridge tops are well rounded; the valleys, although comparatively deep, have gradually sloping sides; and numerous almost level loess-capped remnants of the old constructional plain occur. Probably 90 per cent of the uplands in Saline County is suited to cultivation.

The alluvial lands include the terraces and flood plains and occur as continuous strips of different widths along the larger streams. The broadest strips are along Big Blue River, Swan Creek, and Turkey Creek, and they range from about one-fourth mile to more than 3 miles in width. Narrower strips lie along many of the tributaries to these streams.

The first bottoms are subject to overflow in a few places during periods of high water, but the surplus water drains off soon after the streams subside.

The average elevation of Saline County is about 1,400 feet above sea level. The highest elevations are on the nearly level uplands in the northeastern part and the lowest in the deeper stream valleys in the southeastern part. The altitude [1] at Friend is 1,559 feet, at Tobias 1,597 feet, at Dorchester 1,486 feet, at Western 1,468 feet, at Crete 1,354 feet, at Swanton 1,345 feet, at Wilber 1,325 feet, and at De Witt 1,289 feet above sea level. The general slope of the county is toward the southeast.

The larger streams are intrenched from 40 to 100 feet below the general upland level, and all of them have fairly steep gradients and are actively deepening their channels. Big Blue River is one of the principal streams for the development of water power in Nebraska and furnishes six power sites in its course across the eastern part of Saline County. Water power is also developed on Turkey Creek at Pleasant Hill.

Well water of excellent quality is readily obtained in nearly all parts of the county. Wells in the uplands range in depth from 60 to 200 feet and those in the alluvial lands from 20 to 60 feet.

Saline County is in the prairie region of the United States, and natural tree growth occurs only along the larger streams. The trees include cottonwood, elm, ash, boxelder, and locally hackberry. Most of them are of stunted growth. The natural grasses, in situations not disturbed by cultivation, are of the tall-grass sod type, chiefly big bluestem and little bluestem.

The area comprising Saline County was surveyed and the county was established with its present boundaries in 1855. The first permanent settlements were made in 1858 in the northwestern part of

[1] GANNETT, H. A DICTIONARY OF ALTITUDES IN THE UNITED STATES. (FOURTH EDITION). U. S. Geol. Survey Bul. 274, 1,072 p. 1906.

the county and on Turkey Creek near the present site of Pleasant Hill. The county was organized in 1867, and the first railroad was completed across the county in 1871. The early settlers came largely from the East Central States and were of many nationalities, although a large proportion were of American birth. The 1920 census reports 95.7 per cent of the inhabitants as native white persons and the remainder as foreign-born whites. Those of foreign birth are largely Czechs, Austrians, and Germans.

According to the census data[2] the population of the county has steadily decreased since 1890. It was 39 in 1860, 3,106 in 1870, 14,491 in 1880, 20,097 in 1890, 18,252 in 1900, 17,866 in 1910, 16,514 in 1920, and 16,356 in 1930. The 1930 census classes 82.5 per cent of the population as rural and the density of the rural population as 23.5 persons a square mile. The population, excepting that in the towns and villages, is evenly distributed. Wilber, the county seat, in the east-central part of the county, has a population of 1,352. Crete, in the northeastern part with 2,865 inhabitants, is the largest town, and Friend, in the northwestern part, has 1,214 inhabitants. The remaining incorporated places, including De Witt, Dorchester, Swanton, Western, and Tobias, each with less than 1,000 inhabitants, are all on railroads and are local markets and distributing points for farm implements, supplies, and produce.

The transportation facilities of Saline County are good. Main or branch lines of the Burlington, Rock Island, and Missouri Pacific Railroad systems furnish good connections with outside points. State or Federal highways cross the county in several directions, and many miles of these highways are surfaced with gravel. The county roads are of earth construction but are kept in good repair. Most of them follow section lines. Cement bridges and culverts are common on nearly all roads.

All parts of the county are served by rural mail delivery, telephones are in common use, and the public-school system is highly developed.

CLIMATE

Climate is an important factor in agriculture. It must be considered in the selection of crops best adapted to any region, and it influences crop yields and farming practices regardless of the character of the soils or the care taken in handling the crops.

The climate of Saline County is continental. It is characterized by rather wide variations in temperature between winter and summer but is well suited to the growing of hay crops, vegetables, and grain and the raising of livestock. The springs are usually cool with considerable rainy weather which favors rapid growth of winter wheat and the spring-planted small grain. The summers are long with warm days and nights, conditions especially favorable to corn. Low temperatures sometimes occur in winter but are generally accompanied by snow, which protects winter crops from serious injury. The autumns are long and pleasant with only occasional periods of rainy weather, giving the farmer ample time to prepare and seed the land for winter wheat. The variation in topography is not sufficient to cause appreciable differences in climate within the county.

[2] Soil survey reports are dated as of the year in which the field work was completed. Later census figures are given whenever possible.

The average date of the last killing frost is April 26 and of the first is October 8. This gives an average frost-free period of 164 days which is ample for the maturing and handling of all farm crops common to the region. Killing frosts have occurred as early as September 12 and as late as May 24. During the 20 years from 1895 to 1914 there were five times in which killing frosts occurred 10 or more days earlier in the fall than the average date and four times in which they were 10 or more days later in the spring.

The precipitation varies greatly from year to year. About 67.9 per cent of the mean annual precipitation falls from April to August, inclusive, or during the principal part of the growing season. In the summer the precipitation usually occurs as heavy thundershowers, though torrential rains are rare. Droughts are almost unknown during May and June, but in the latter part of July and during August short dry periods sometimes occur. However, crops seldom suffer from lack of moisture when properly tended, as nearly all the soils have a high available moisture capacity.

The annual snowfall ranges from a few inches to several feet and averages 23 inches.

From about October 1 to April 1 the prevailing wind is from the northwest, and during the remainder of the year it is from a southerly direction. Strong winds are common, but tornadoes are rare.

Table 1, compiled from the records of the Weather Bureau station at Crete in the northeastern part of the county, gives the normal monthly, seasonal, and annual temperature and precipitation.

TABLE 1.—*Normal monthly, seasonal, and annual temperature and precipitation at Crete, Nebr.*

[Elevation, 1,368 feet]

Month	Temperature			Precipitation			
	Mean	Absolute maximum	Absolute minimum	Mean	Total amount for the driest year (1895)	Total amount for the wettest year (1902)	Snow, average depth
	° *F.*	° *F.*	° *F.*	*Inches*	*Inches*	*Inches*	*Inches*
December	27.3	68	−22	0.80	0.02	1.84	4.7
January	22.7	67	−27	.57	.37	.79	3.7
February	25.6	78	−27	.89	1.10	.27	6.6
Winter	25.2	78	−27	2.26	1.49	2.90	15.0
March	37.5	90	−11	1.28	.71	.40	5.2
April	53.4	96	12	2.60	1.54	1.00	1.0
May	61.1	98	23	4.25	1.87	4.77	.1
Spring	50.7	98	−11	8.13	4.12	6.17	6.3
June	70.9	105	40	4.62	5.70	8.36	0
July	76.2	110	44	4.11	1.23	13.17	0
August	74.2	109	42	3.42	6.29	2.42	0
Summer	73.8	110	40	12.15	13.22	23.95	0
September	66.7	103	23	2.30	.79	4.69	0
October	54.3	94	14	2.20	.18	3.84	.4
November	39.5	79	−7	.95	.91	1.33	1.3
Fall	53.5	103	−7	5.45	1.88	9.86	1.7
Year	50.8	110	−27	27.99	20.71	42.88	23.0

AGRICULTURE

Prior to 1858 the area now included in Saline County supported a luxuriant growth of prairie grasses associated, along the larger streams, with narrow strips of tree growth. The land was inhabited by Indians, hunters, and cattlemen. The cattlemen practiced cattle raising exclusively, grazing their animals on the open range, where a great variety of nutritious grasses afforded good pasture. Livestock losses were often very heavy during the winters, as the cattle had little protection, but the range was free and the profit on the surviving animals was large. Prior to 1863 there were only 15 farm settlements in the county, and the cattle-raising industry prospered until about 1865, but within the next few years settlers became so numerous that the cattlemen were forced to move farther west. Subsequent to 1871, when the first railroad was constructed across the county, settlement was very rapid, and by 1875 most of the desirable land had been taken up under the homestead and preemption laws.

Sod corn was usually the first crop planted by the settlers, and corn, together with game and beef, formed their chief food. As conditions became more stable, spring wheat, oats, barley, and garden vegetables were grown.

Early agricultural development was slow. The settlers were not familiar with local climatic and soil requirements. Their seed, brought largely from eastern States, was not suited to the climatic conditions and in consequence yields were often low. In 1874 most of the crops were destroyed by grasshoppers, and in the early nineties droughts were especially severe. Some of the farmers became so impoverished that they were forced to leave the county. However, as new immigrants were continually arriving, the population steadily increased until 1890.

Table 2 gives the acreage and production of the principal crops in Saline County as reported by the Federal census for the years 1879 to 1919, inclusive, and as reported in the Nebraska Agricultural Statistics [3] for the year 1928.

TABLE 2.—*Acreage and production of principal crops in Saline County, Nebr., in stated years*

Crop	1879		1889		1890	
	Acres	*Bushels*	*Acres*	*Bushels*	*Acres*	*Bushels*
Corn	57,480	2,310,851	134,851	6,437,670	169,881	4,653,330
Wheat	57,619	569,511	12,185	215,721	19,188	264,400
Oats	8,714	252,486	37,956	1,428,350	51,614	1,698,350
Rye	1,071	12,048	1,684	29,947	2,679	46,010
Barley	9,304	118,016	759	18,951	2,354	60,120
Potatoes		79,595	1,697	155,105	1,472	167,149
		Tons		*Tons*		*Tons*
Hay, all kinds	10,524	12,817	38,093	46,251		
Tame hay					6,358	11,826
Clover alone					798	1,271
Alfalfa					624	1,719
Millet and Hungarian grass					3,175	6,341
Wild hay					18,208	18,514
	Trees	*Bushels*	*Trees*	*Bushels*	*Trees*	*Bushels*
Apples			37,944	34,111	125,959	42,729

[3] ANDERSON, A. E., and FORSYTH, W. H. (compilers). NEBRASKA AGRICULTURAL STATISTICS, 1928. (Issued cooperatively by U. S. Dept. of Agr., div. crops and livestock estimates, and Nebr. State dept. of agr., div. of agr. statis.), 198 p., illus. Lincoln, Nebr. 1929.

TABLE 2.—*Acreage and production of principal crops in Saline County, Nebr., in stated years*—Continued

Crop	1909		1919		1928	
	Acres	*Bushels*	*Acres*	*Bushels*	*Acres*	*Bushels*
Corn	106,283	2,425,366	85,364	1,272,869	87,438	2,885,454
Wheat	74,558	1,529,987	104,364	1,738,196	99,031	2,178,106
Oats	40,732	923,034	32,834	1,121,313	32,606	1,206,422
Rye	111	1,496	519	5,746	247	4,693
Barley	356	7,474	2,281	56,034	296	9,176
Potatoes	1,080	80,817	721	30,345	542	61,788
		Tons		*Tons*		*Tons*
Hay, all kinds:						
Tame hay	18,948	32,758	19,317	32,660	16,628	30,902
Timothy alone	2,652	3,379	2,384	3,108	378	491
Clover alone	895	1,138	264	379	913	1,932
Timothy and clover	8,435	11,067	1,360	1,720	451	631
Alfalfa	5,954	15,417	14,578	26,559	13,800	34,500
Millet and Hungarian grass	662	1,329				
Sweetclover (pasture and hay)					5,175	
Wild hay	15,931	19,680	13,571	14,347	12,594	13,853
	Trees	*Bushels*	*Trees*	*Bushels*	*Trees*	*Bushels*
Apples	85,675	83,019	8,264	5,109	18,474	

Table 3 gives the number and value of all domestic animals and poultry in Saline County as reported by the Federal census for the years 1910 and 1920, and as reported in the Nebraska Agricultural Statistics for the year 1928. The number of animals reported by the Federal census for the years 1910 and 1920 are only relatively comparable, as the numbers given in the 1910 census are as of the date April 1, and in the 1920 census are as of the date January 1 and do not include the normal spring increase.

TABLE 3.—*Number and value of domestic animals and poultry on farms in stated years*

Animals	1910		1920		1928	
	Number	*Value*	*Number*	*Value*	*Number*	*Value*
Horses	13,943	$1,513,924	12,458	$1,059,175	10,874	$646,699
Mules	1,283	176,352	1,221	137,178	1,441	107,362
Asses and burros	9	1,657	9	2,715		
Cattle	26,163	554,036	25,972	1,194,925	23,190	1,190,917
Sheep	2,615	12,448	1,922	22,170	5,166	47,162
Goats	60	163	11	55		
Swine	49,631	370,426	39,305	774,539	58,435	896,405
Poultry	209,452	92,036	251,731	211,241	360,272	315,238

According to the Nebraska Agricultural Statistics the value of all crops in Saline County except fruit, seed, and sorghum sirup was $5,140,129 in 1928. The value of all livestock, including poultry on hand January 1, 1929, was $3,203,783. Dairy products, excluding butter and whole milk sold or consumed on the farms, were produced to the value of $378,073 and poultry and eggs to the value of $736,556 in 1928.

The Federal census reports for 1930 show that 99.5 per cent of the county is in farms and that a large proportion of the farm land is improved. Most of the farms range in size from 50 to 500 acres. The average size is 174.8 acres.

Owners occupy 64.8 per cent and tenants 35.1 per cent of the farms, the remainder being occupied by managers. On farms occupied by tenants either the cash or share rental systems or sometimes a combination of the two is used. The share system is the most popular,

and 88 per cent of the rented land was rented for a share of the crops in 1928. Under this system the owner usually receives two-fifths of the grain delivered to him by the tenant and from $3 to $4 an acre for the pasture land. All seed, labor, and machinery is furnished by the tenant. When alfalfa land is rented on shares the owner receives one-half the hay stacked in the field. Under the cash system the tenant usually pays from $5 to $7 an acre for the land including the pasture land. On some farms the renter is allowed the use of the pasture land without charge. Very little of the land suitable for grain production is rented for cash.

The industries of Saline County are closely related to the utilization of the crops grown. Corn and winter wheat are the most important crops, corn usually exceeding wheat in acreage. These crops are followed by oats, alfalfa, wild hay, sweetclover, barley, timothy and clover mixed, potatoes, and rye, which during most years rank in acreage in about the order given. Wheat is the chief cash crop. Some of it is purchased by local millers, but as wheat production greatly exceeds its consumption in Saline County the greater part of the grain is sold at elevators for shipment to outside markets.

Most of the leading crop (corn) and practically all of the alfalfa and small grains, with the exception of wheat, are used on the farm where produced for feeding livestock, returns derived from the sale of livestock and livestock products being the chief sources of revenue in Saline County.

Potatoes, fruits, and garden vegetables are grown only for family consumption.

Cattle fattening and hog raising and feeding are the most important branches of the livestock industry. Very few cattle are raised locally because most of the land is too valuable to warrant its use for grazing land. Most of the cattle to be fattened are purchased when 2 or 3 years old either from the Omaha markets or from ranches in counties farther west. They are fed corn and alfalfa for a period ranging from 60 to 90 days and then shipped to Omaha or Chicago. Many farmers fatten from 1 to 3 carloads of cattle each year, and a few farmers feed cattle by contract. Under one form of contract the owner delivers the cattle to the farmer and allows him a fixed price a pound for all gain in weight, and at the end of the feeding period the owner ships the cattle to market. Another system is to allow the farmer a few dollars a head plus the market price for all grain and hay used in fattening. Most of the beef cattle are of grade Hereford or Shorthorn breeding.

Each farmer raises from 20 to 60 hogs a year, and a few herds number several hundred. Practically all the hogs are raised on corn and alfalfa, although barley and rye are sometimes added to the ration. Many hogs are raised in connection with the feeding of beef cattle, and practically all the hogs in Saline County are fattened on the farms where raised. All the hogs are of good breeding and there are numerous purebred herds in the county, Duroc-Jersey, Poland China, and Hampshire being the leading breeds. Most of the hogs are sold in Omaha. Cholera sometimes disastrously affects hog raising, but the disease can be largely controlled through vaccination and increased sanitation.

Dairy products are an important source of income on most farms. Only a few farms are devoted exclusively to dairying, but most farmers

keep from 5 to 10 milk cows, chiefly of mixed beef and dairy breeding, and sell their surplus dairy products to local cream buyers. Cream routes are established in nearly all parts of the county and most of the cream is collected by the purchasers. A large creamery is operated in Crete. Purebred dairy herds, chiefly Holstein, are kept on a few farms in the vicinity of the larger towns. The abundance of alfalfa to balance the corn ration and good market facilities favor the extension of the dairy industry.

A few farmers annually ship in a carload or two of sheep for fattening, but practically no sheep are raised in the county. The sheep to be fattened are fed corn, alfalfa, and sweetclover, and are sold in the Omaha market when the price is favorable.

Horse raising consists chiefly in the breeding of the work mares. Most of the horses are of Percheron breeding, and purebred stallions are kept on a few farms.

Chickens are a valuable asset on most farms. The local demand for poultry products is increasing, and poultry raising is receiving considerable attention. Most farmers have 50 or 60 chickens and many maintain purebred flocks of several hundred. The principal breeds are Plymouth Rock, Leghorn, and Rhode Island Red. Poultry products are either sold or exchanged for farm supplies in the local towns.

Farm management and the methods used in growing and harvesting the crops in Saline County are similar to those prevailing throughout eastern Nebraska. The most modern machinery is used in nearly all farming operations.

Corn is planted between the first and middle of May. The crop is cultivated at intervals of two or three weeks until early in July when it is "laid by" and receives no further attention until harvest, except to remove the more injurious weeds by hoeing. The crop matures in September or early in October depending on the season. The greater part of the grain is husked from the standing stalks, after which cattle and horses are pastured in the fields until spring. Some farmers cut part of the corn for fodder. On farms equipped with silos, from 15 to 20 acres of corn are cut each year for silage. Many farmers annually fence off a few acres of unhusked corn for fattening hogs and cattle, thereby saving part of the expense of husking the crop.

The chief varieties of corn grown are Reid Yellow Dent and Iowa Silvermine, but careful seed selection is not generally practiced. Many farmers purchase seed grown outside the county, but this practice is not usually rewarded by high yields because such seed, although belonging to one or another of the varieties known to be well suited to the county, may have become adapted to different climatic and soil conditions than those under which it is to be grown. In a publication[4] from the Nebraska experiment station at Lincoln is the following statement regarding the significance of corn varieties to corn yields: "It is more important to know to what conditions a corn has become adapted than to know the variety to which it belongs." Recommendations for seed selection by the same experiment station include the advisability of selecting seed from corn known to have been grown in the locality and to have become adapted to local climatic and soil conditions.

[4] KIESSELBACH, T. A. PRODUCTIVE SEED CORN. Nebr. Agr. Expt. Sta. Bul. 188, 35 p., illus. 1923.

Throughout most of the county corn usually follows small grain in rotations. On the subirrigated soils of the bottom lands, however, it frequently follows alfalfa. Corn is often grown on the same land five or six years in succession, especially on tenant farms.

Practically all the wheat grown in Saline County is of the winter varieties, chiefly Kanred. Most of the wheat is planted with a press drill on plowed and harrowed corn or stubble land in the latter part of September. The seed germinates and the crop usually makes good growth before killing frosts occur. The young plants remain dormant during the winter and resume growth in early spring. The crop, which usually matures in July, is cut and shocked or stacked for threshing. Most of the wheat is sold direct from the threshing machine, although a few farmers store the grain for more favorable markets.

The wheat crop is sometimes injured by stinking smut which distorts the kernels, prevents their natural growth, and gives the grain an offensive odor. A complete description of this form of smut and methods for its control are given in a circular[6] published by the Nebraska Experiment Station.

Wheat is generally grown on the same land two years in succession. It usually follows oats and is followed by oats or corn in the rotation.

Oats are not considered a very profitable crop in Saline County although they are necessary for horse feed and are valuable as a step in the rotation between corn and wheat or alfalfa. The crop is seldom grown on the same land two years in succession. Oats are planted and harvested in the same manner as wheat, but the land is prepared and the grain is planted in the spring instead of in the fall. All the crop is usually consumed on the farm where produced. Kherson is probably the chief variety grown, and Nebraska No. 21 is also an important variety which is being grown more extensively each year as it yields a little higher than Kherson.

Smut sometimes lowers oat yields during prolonged periods of rainy or cloudy weather. Injury from this source, however, can be largely reduced by killing the smut spores with formaldehyde before the seed is planted.

Rye is grown chiefly for the grain but to some extent for hay and pasture. The methods of preparing the land and of planting and harvesting the crop are the same as those used in the production of winter wheat. Most of the rye is fed to hogs on the farms where grown.

Barley is grown chiefly for hog feed, but it is not an important crop in Saline County. The common 6-rowed smooth-bearded variety has proved more productive than any of the beardless varieties. The seed is planted and the crop harvested in the same manner as oats.

Alfalfa seed is usually sown either in April or August. An important factor in obtaining a good stand of this crop is thorough seed-bed preparation. The seed is either sown broadcast and harrowed in or planted with a press drill at the rate of 15 pounds of good seed an acre. The varieties of alfalfa grown are among the most hardy obtainable and include Common, Grimm, and Cossack, all of which are resistant to winterkilling. A stand of alfalfa is usually allowed to remain

[6] NEBRASKA UNIVERSITY, AGRICULTURAL COLLEGE EXTENSION SERVICE, DEPARTMENTS OF BOTANY AND PLANT PATHOLOGY. CEREAL SMUTS AND THEIR CONTROL. Nebr. Agr. Col. Ext. Cir. 126, 8 p., illus. 1925.

5 or 6 years on upland soils and from 10 to 14 years on the subirrigated soils of the first bottoms and lower terraces. A field is rarely frozen out. The crop is usually cut three times during the summer, and occasionally a fourth cutting is obtained. The hay is usually stacked in the field and hauled to the feed lots as needed. It is fed to cattle and hogs but seldom to work animals because of its laxative properties. Hogs are often run in the alfalfa fields during the summer, but cattle are seldom allowed to graze for long periods on green alfalfa on account of the danger of bloating.

Considerable wild hay is still produced in Saline County. Most of it is cut in depressions throughout the uplands and on slopes too steep for cultivation. Most of the hay cut from the depressions consists of water-loving grasses and sedges and is rather coarse textured, whereas that from the slopes consists chiefly of big bluestem and little bluestem and is of excellent quality. Practically all the wild hay is stacked in the fields or stored in barns for winter feeding.

Sweetclover, although of minor importance in Saline County, is grown on many farms for cattle and hog pasture and is also grown locally for hay and seed. Land to be used for this crop is prepared in the same manner as for alfalfa. Sweetclover has an unusually wide adaptation, as it thrives on both comparatively wet and dry soils and on soils of either coarse or fine texture. It is very valuable for soil improvement, as it not only adds organic matter to the soil but, in common with other legumes, has the power of fixing atmospheric nitrogen in the nodules on the roots, and it probably improves the productivity of the soil as fast as alfalfa. It is adapted to short rotations, is a good soil binder, being especially valuable on steep slopes where erosion is severe, and it is being grown more extensively each year.

Mixed stands of timothy and clover are grown on a few farms for hay, mainly on the bottom lands and lower terraces where moisture conditions are most favorable. The land is prepared in the same manner as for alfalfa. The seed is usually sown broadcast at the rate of 10 or 12 pounds of timothy and an equal amount of red-clover seed an acre and is harrowed in. The hay is cut once each year, and most of it is fed to work animals.

No commercial fertilizer is used in Saline County. Considerable barnyard manure is produced but on most farms little care is taken to preserve it, as it is usually piled out of doors where much of its fertilizing value is lost by leaching. The manure is hauled in the fall or spring and generally spread on the land to be used for corn or wheat, but on tenant farms little care is taken in applying the manure where it is most needed, and the greater part is spread on the land near the barnyard.

SOILS AND CROPS

The soils of Saline County are naturally productive. They have been formed under a prairie-grass vegetation, and the decaying grass roots through ages past have produced an abundance of black decomposed vegetable material commonly known as organic matter. This material in most places has become mixed with the mineral soil constituents, especially in the upper soil layers, making these layers very dark colored. The intensity of the color and the depth to which the dark color has penetrated depends largely on the relief.

In the more nearly level well-drained parts of the county, with the exception of those parts covered by recently deposited light-colored sediments, decomposed vegetable material is most abundant and has penetrated deepest into the soils. On steep eroded slopes the organic matter is removed almost as fast as it is formed, and the soils are light colored even on the surface. Between these topographic extremes the content of organic matter in the soils and the depth to which it has penetrated differs, depending on the degree of slope. However, slopes sufficiently steep to greatly restrict accumulations of organic matter are local and inextensive in Saline County, being confined chiefly to narrow strips on the valley sides along Turkey Creek and some of its tributaries in the northern part of the county and to similar strips in the Swan Creek drainage basin in the southwestern and southern parts. Organic-matter accumulations are also somewhat restricted in the surface layers of soils occupying the deeper and more poorly drained depressions throughout the uplands, but the areas of such soils are small.

In addition to their prevailingly dark color, the soils of Saline County are characterized by a crumblike or granular structure in their topsoils, this feature persisting to greater or less extent in all except the more sandy soils.

A third fairly uniform characteristic in the soils of the county is the occurrence, in most places, of lime in sufficient quantities for crop needs. This characteristic, however, is less persistent and in many places less pronounced than the dark color and crumblike structure previously mentioned. Lime in most places is not abundant in the topsoils and does not everywhere occur in noticeable quantities in the subsoils, but none of the soils shows evidence of lime deficiency, except in a few local upland depressions where water stands for considerable periods and downward seepage has carried the lime away in the underdrainage. Sufficient lime to be visible to the naked eye occurs in most of the subsoils throughout the county.

These three rather persistent characteristics, the high organic-matter content of the topsoils, their granular or crumblike structure, and the high calcium carbonate content of the subsoils, are valuable soil assets in the production of crops. The organic matter is a strong absorbent of both heat and moisture, as it increases the water-holding capacity of the soil, assists in maintaining a uniform temperature, and makes the soil loose and mellow, qualities which promote favorable tilth. Organic matter is also the chief source of nitrogen, an important plant food. The granular or crumblike structure facilitates easy penetration of crop roots and allows free passage of air and water which change the raw vegetable and mineral constituents of the soil into food suitable for the growing crops. Lime, when present in sufficient quantities, prevents the soil from becoming sour, or acid, and assists in preserving the organic-matter supply and the crumblike structure.

The general soil characteristics mentioned favor the production of corn, small grain, and hay, crops on which the prosperity of the inhabitants of Saline County largely depends. Nearly all the soils in the county will produce these crops and the intricate soil associations on many farms necessitates using them to greater or less extent for each of the crops commonly grown. However, all the soils can not be used for all crops with equal economy because they

are not exactly alike. Some have very compact subsoils which are penetrated with difficulty by water, air, and roots, whereas others have comparatively friable subsoils. Some are characterized by a high water table and an unusually favorable moisture supply, and others are sandy, incoherent, and have a tendency to drift during dry, windy weather. Some of the soils are low in organic matter; some have poor drainage; in fact, each of the soils shown on the accompanying map differs from every other soil shown in one or more characteristics. Some of the soil characteristics are purely technical in character and not of great agricultural importance, but most of them influence the crop adaptabilities and producing powers of the soils to greater or less extent.

On the basis of soil characteristics and other features that affect agriculture, the soils of Saline County may be separated into the following three broad groups: Upland and terrace soils with friable subsoils, upland soils with claypan subsoils, and bottom-land soils. Each of these groups includes several soils which are used more or less extensively for all crops common to the region, but a greater proportion of the soils in any one group is used for some particular crop or crops than is similarly used in either of the other groups.

In the following pages the individual soils of the different groups are described in detail and their crop adaptabilities are discussed; the soil map accompanying this report shows the distribution of the soils in the county; and Table 4 gives their acreage and proportionate extent.

TABLE 4.—*Acreage and proportionate extent of the soils mapped in Saline County, Nebr.*

Type of soil	Acres	Per cent	Type of soil	Acres	Per cent
Hastings silt loam	92,480	25.2	Fillmore silt loam	1,472	0.4
Hastings silt loam, slope phase	50,112	13.7	Scott silt loam	448	.1
Carrington silt loam	41,920	11.4	Wabash silt loam	34,432	9.4
Carrington loam	19,840	5.4	Wabash very fine sandy loam	12,544	3.4
Shelby loamy sand	640	.2	Lamoure silt loam	1,280	.3
Nuckolls silt loam	3,008	.8	Lamoure very fine sandy loam	256	.1
Waukesha silt loam	9,792	2.7	Cass very fine sandy loam	5,184	1.4
Waukesha very fine sandy loam	1,984	.5	Cass silt loam	320	.1
Hall silt loam	7,296	2.0	Sarpy very fine sandy loam	256	.1
Creto silt loam	75,072	20.5			
Butler silt loam	8,384	2.3	Total	366,720	

UPLAND AND TERRACE SOILS WITH FRIABLE SUBSOILS

This group includes the Hastings, Carrington, Shelby, and Nuckolls soils on the uplands and the Waukesha and Hall soils on the terraces. The Hastings, Waukesha, and Hall soils have weathered from the gray floury and limy loess formation which covers most of the county. The Nuckolls soils are developed on exposures of reddish-brown silt loam or very fine sandy loam which immediately underlie the gray loess and is known by State geologists as the "Loveland phase" of the loess. The Carrington and Shelby soils have weathered from exposures of a still lower-lying formation consisting of a heterogeneous mixture of sand, clay, and granitic cobblestones, which were deposited by the ice during glacial times.

The soils of this group occupy about 62 per cent of the area of the county and one or another of them occurs in all parts except in some

of the more nearly level parts of the uplands, in upland basins or depressions, and in the first bottoms or flood plains. The surface relief of these soils ranges from steeply sloping to nearly level. The greater part of the soils occupying upland positions is gently rolling, and practically all the terrace soils of the group are nearly level. Drainage is well developed, and in some places throughout the uplands surface run-off is rapid and erosion rather severe. Only a small proportion of the land is too rough for cultivation.

The topsoils of the soils of this group are deep and dark, except locally on steep hill or valley sides, and all of them are loose and mellow. The subsoils are friable, allowing easy root penetration and free air and water movement. The soils have high moisture-storing capacity throughout, and they are well adapted to all crops commonly grown in the county. Corn is grown on about 70 per cent of the area occupied by soils of this group, because the largest returns are obtained through cattle and hog feeding, both of which require an abundance of corn for feed. That part of the soils not needed for corn is used chiefly for small grains, of which winter wheat and oats, in about the proportion of 3 acres of wheat to 1 of oats, are the most important. Hay crops, including alfalfa, sweetclover, and prairie hay, are also produced but are of minor importance. Most of the prairie hay is cut from areas too steeply sloping for cultivation. As the soils of this group occupy the greater part of Saline County, corn is naturally the leading crop.

Hastings silt loam.—Hastings silt loam, together with its slope phase, is the most extensive soil in Saline County, occurring throughout the uplands in nearly all parts. The surface relief ranges from nearly level to gently rolling, and most of the soil occurs on broad nearly level or gently undulating divides. This soil has developed from light-gray loess material under conditions of good surface drainage and underdrainage. The topsoil is well supplied with organic matter, is very dark, and ranges in thickness from 20 to 24 inches. It is everywhere loose and mellow and has a well-developed crumblike structure, the crumbs or granules being largest in the lower part of the topsoil but few exceeding one-fourth inch in any dimension. The upper part of the subsoil is moderately compact and somewhat cloddy, especially when dry, but is not sufficiently dense to restrict root development or the movement of soil moisture. The lower part of the subsoil consists of loose flourlike silt and is limy throughout. It is underlain by gray loess.

The organic matter with which Hastings silt loam is so well supplied, is most abundant in the upper 6-inch layer of the topsoil where it averages about 5 per cent by weight of the soil material and thoroughly impregnates the small crumbs or granules. Between depths of 6 and 12 inches the organic matter is a little less abundant, comprising about 3 per cent of the soil material. It is also less uniformly distributed than in the immediate surface layer, the greater part occurring as coatings on the outside of the granules. The coatings become thinner with depth, and the soil material becomes lighter in color. The upper part of the subsoil is brown in contrast to the almost black color in the upper 6 inches of the topsoil. The lower part of the subsoil has received practically no organic material and is light gray in color.

Hastings silt loam is well adapted to all crops common to the region and on account of its large extent is the most important agricultural soil of the county. Practically all the land is under cultivation. This soil is more productive in most years than any other soil in the county, except the finer-textured and better-drained bottom-land soils and the terrace soils. The bottom-land and terrace soils receive some moisture through seepage which, combined with that obtained from precipitation, gives them a slight advantage over Hastings silt loam, especially for corn and alfalfa. However, the alluvial soils are comparatively inextensive, and many of them are poorly adapted to small-grain production.

Crop yields on Hastings silt loam, although fairly uniform from year to year, are a little more variable, particularly those of corn, than on the best upland soils of more eastern States, owing largely to a slightly greater variation in the annual rainfall. However, the soil compares favorably in productiveness with the leading upland soils of the Mississippi Valley. Corn yields range from 25 to 65 bushels, with an average of about 35 bushels an acre. Wheat yields from 12 to 60 bushels, averaging about 25 bushels. The oat yield is about the same as that of corn, and the acre yield of rye is the same or a few bushels less than of wheat. The average yield of barley is about 25 bushels, and alfalfa yields from 2 to 3 tons of hay.

Although Hastings silt loam is better adapted to alfalfa production than any of the other upland soils in the county, it is, in common with nearly all upland soils of Nebraska, rather poorly suited to continued alfalfa production. The crop does well during the first few seasons, but the yields decline after five or six years, on account of insufficient moisture, and a second cropping to alfalfa on this soil is seldom as profitable as the first. The alfalfa plant has an exceptionally long root system and extracts soil moisture from a considerable depth.

A recent publication [6] by agronomists at the Nebraska Experiment Station shows that alfalfa on soil receiving moisture from precipitation alone, as do most of the upland soils of Saline County, can deplete the stored soil moisture to depths far beyond the reach of ordinary cereal crops within two years, and within five or six years can almost completely exhaust the available moisture in the lower soil layers to a depth exceeding 25 feet. The publication indicates that alfalfa in Nebraska must depend almost entirely on precipitation for its growth after the first five or six years except in situations where the precipitation is supplemented by a favorable moisture supply from other sources. Throughout the uplands, therefore, reduced yields may be expected from a second cropping to alfalfa because the alfalfa plant requires more moisture for its maximum production than is supplied by the normal precipitation.

The removal of deep-seated moisture in the upland soils by alfalfa does not materially affect grain crops because these crops dry the soil as deep as their roots extend equally as fully as does alfalfa. However, unfavorable yields of grain crops following alfalfa on Hastings silt loam and other upland soils frequently occur, but this is because the normal supply of soil moisture is insufficient for the increased vegetative growth produced in subsequent crops by the nitrogen stored in the soil by the alfalfa.

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[6] KIESSELBACH, T. A., RUSSEL, J. C., and ANDERSON, A. THE SIGNIFICANCE OF SUBSOIL MOISTURE IN ALFALFA PRODUCTION. Jour. Amer. Soc. Agron. 21: 241-268, illus. 1929.

Hastings silt loam, slope phase.—The slope phase of Hastings silt loam is similar to typical Hastings silt loam in all respects except surface relief and depth of the topsoil. This soil has developed from light-gray loess similar to that underlying typical Hastings silt loam. It occupies slopes between Hastings silt loam areas and the alluvial lands along streams and has been subjected to a little more erosion. Its topsoil is more variable in depth, and it averages considerably thinner than that of typical Hastings silt loam, but areas of the slope phase having less than 10 inches of dark topsoil are very few.

This soil is well adapted to all crops commonly grown in the county, but it is not quite so well supplied with organic matter and, therefore, nitrogen as typical Hastings silt loam. In addition the slope of the land favors considerable run-off, and less of the precipitation sinks into the ground than on typical Hastings silt loam. About 95 per cent of the area occupied by the phase is topographically suited to cultivation, and, although the soil gives slightly lower yields of corn and small grains than does Hastings silt loam, it is very productive. It seems to produce alfalfa as well as any upland soil in the county probably because this crop is able to obtain most of its nitrogen from the air and much of its moisture supply from great depths, but alfalfa yields decline after five or six cropping seasons as on Hastings silt loam.

Carrington silt loam.—Carrington silt loam is the most extensive soil which has developed on formations beneath the gray upland loess in Saline County. It occurs chiefly in the southern and southwestern parts of the county where it usually occupies narrow strips on valley slopes, but it may extend over low and rolling or moderately hilly divides. Areas are most numerous in the Swan Creek drainage basin. A few bodies occur in the northeastern part of the county. Drainage is thorough and in a few places is excessive.

The topsoil, except locally, has retained large amounts of organic matter and is very dark. It is slightly thinner than the topsoil of Hastings silt loam and contains a few pebbles, but it is loose and granular or crumblike and very similar to that soil except for the differences mentioned. The upper subsoil layer is brown moderately compact clay loam, but it is not sufficiently dense to restrict water and root penetration. It also contains a few pebbles but is otherwise similar to the corresponding layer of Hastings silt loam. The lower subsoil layer is variable. It rests on glacial drift and its characteristics in any particular locality depend largely on the character of the glacial material at that place. In most places the lower subsoil layer is gray moderately compact sandy clay containing a few pebbles. In some places the material in this layer is brown or reddish brown. Locally it consists of a heterogeneous mass of sand and pebbles loosely held together. The soil is low in lime although the underlying drift may be very limy at a depth of 5 or 6 feet.

About 85 per cent of Carrington silt loam is under cultivation. The cultivated areas are used for the same crops as are grown on Hastings silt loam, and yields average only a trifle lower than those obtained on that soil. The average yield of corn is about 32 bushels and of wheat 20 bushels an acre. Oats yield from 30 to 50 bushels, rye about 23 bushels, and barley from 18 to 30 bushels. About 80 per cent of the cultivated land is devoted to corn and wheat, each occupying about equal acreages. Very little alfalfa is grown on this soil probably on

account of the low lime content in the upper part of the soil. The uncultivated areas are used for pasture and hay land.

Carrington loam.—Carrington loam differs from Carrington silt loam only in having a slightly higher sand and gravel content in its topsoil, but the coarse material is not sufficiently abundant to hinder cultivation or noticeably reduce the producing power of the soil. This soil occurs in scattered bodies and narrow fairly continuous strips on the lower valley slopes in nearly all parts of the county and is most extensive in the southern and southwestern parts, where it occurs in close association with Carrington silt loam. About 90 per cent of the soil is under cultivation, chiefly to corn and wheat. Crop yields are about the same as those obtained on Carrington silt loam, in fact, Carrington loam and Carrington silt loam are regarded with equal favor by most farmers.

Shelby loamy sand.—Shelby loamy sand occupies a few local patches on the lower valley slopes. This soil has weathered from glacial deposits but differs from the Carrington soils in that it is composed largely of sand and gravel and has a lower organic-matter content. The topsoil, although usually very dark, in few places exceeds 6 or 8 inches in thickness and consists largely of fine or medium sand containing considerable gravel. The clay content in most places is insufficient to give the soil much body, and consequently it is rather unstable. The subsoil is a rather incoherent mass of gray clay, sand, or sand and gravel, and is very low in lime.

Most of the Shelby loamy sand is used for corn, and yields are low except in the most favorable years. Small-grain crops are seldom grown on this soil on account of the danger of the sand drifting and exposing the shallow root systems to drought. That part of the soil not in corn is used for pasture. The soil is inextensive in Saline County. The largest development, comprising about 320 acres, is along Turkey Creek southwest of Friend.

Nuckolls silt loam.—Nuckolls silt loam occupies a few small areas, chiefly in the southwestern quarter of the county. The largest bodies are along North Fork Swan Creek, where the soil occupies gentle valley slopes or low rolling or undulating divides similar to those which characterize the Carrington soils. This soil has developed from the reddish-brown Loveland phase of loess instead of glacial drift, and it is stone free. Drainage is good but in few places excessive. The topsoil has accumulated large amounts of organic matter and resembles that of Hastings silt loam except that it is slightly thinner. The upper subsoil layer is a little more friable than the corresponding layer in Hastings silt loam and has a decidedly red cast in contrast to the brown color of the corresponding layer in the Hastings soil. It is fine in texture, being composed largely of silty material. The lower subsoil layer is reddish-brown friable silt loam or very fine sandy loam and is rich in lime.

Practically all this soil is under cultivation, mainly to corn and wheat, but any crop common to the region can be successfully grown. Yields are about the same as those obtained on Carrington loam. Owing to its silty stone-free character, the soil is easily maintained in good tilth and, if more extensive, would be an important agricultural soil in Saline County.

Waukesha silt loam.—Waukesha silt loam occupies about 51 per cent of the terrace land in the county, occurring in bodies of various

sizes in all the larger stream valleys, but chiefly in those occupied by Big Blue River, Turkey Creek, and Swan Creek. The soil occurs on several terrace levels. It has been formed through the weathering of light-colored loess similar to that underlying Hastings silt loam of the uplands, but the loess was carried to its present position by streams and deposited along their courses when they were flowing at higher levels. The highest-lying areas are on the east side of Big Blue River in the southeastern quarter of the county, where much of the soil lies from 40 to 50 feet above the bottom lands, but in most other places it occurs from 10 to 20 feet above the stream channels. The land is nearly level or gently undulating, but the slope down the valleys and toward the streams is sufficient to afford ample surface drainage, and the subsoil affords good underdrainage.

The topsoil is very dark granular friable silt loam, from 16 to 20 inches thick. It is well supplied with organic matter. The upper part of the subsoil is brown or grayish-brown silt loam, which is a little more compact than the topsoil but is friable throughout. The lower part of the subsoil, beginning at a depth of about 4 feet, is light-gray floury silt which continues to a depth exceeding 7 feet. The soil is remarkably uniform throughout its occurrence in Saline County. It does not contain sufficient lime to produce perceptible effervescence when acid is applied but shows no deficiency in lime so far as crop needs are concerned.

Practically all the land is under cultivation. Owing to its lower position it has a more favorable moisture supply, especially for corn and alfalfa, than any of the other upland soils in the county and produces slightly higher yields of these crops than are obtained on Hastings silt loam. Small-grain yields are apparently no larger than on the Hastings soils and in years of unusually high precipitation are a trifle lower owing to rank vegetative growth at the expense of the grain. The average yield of corn over a period of years is about 38 bushels an acre, of wheat 20 bushels, of oats 35 bushels, and of alfalfa about 3 tons.

Waukesha very fine sandy loam.—Waukesha very fine sandy loam occupies a few small areas on low terraces, chiefly in the valleys of Big Blue River, Swan Creek, and Turkey Creek. All the land is well drained and under cultivation. This soil resembles Waukesha silt loam in all features except the texture of its topsoil, which contains a little more sand than occurs in the corresponding layer of the silt loam. This textural difference does not seem to cause any differences in the crop yields or adaptabilities of the two soils, and both are used with about equal results for all crops common to the region. However, Waukesha very fine sandy loam is of minor agricultural importance in Saline County on account of its small extent.

Hall silt loam.—Hall silt loam occupies both high and low terraces which are closely associated with and have surface features similar to corresponding terraces occupied by Waukesha silt loam, and the two soils are about equally extensive in Saline County. They differ from one another only in the lime content of their subsoils. The subsoil of Hall silt loam contains an abundance of lime, whereas the corresponding layer in Waukesha silt loam is not so well supplied

with this material. Practically all the Hall silt loam is under cultivation to the same crops as are grown on Waukesha silt loam, and yields compare favorably with those obtained on the Waukesha soil.

UPLAND SOILS WITH CLAYPAN SUBSOILS

The soils of this group occupy 23.3 per cent of the area of the county. The group includes the Crete, Butler, Fillmore, and Scott silt loams. These soils occupy nearly level or depressed areas throughout the loess-covered uplands, chiefly in the southwestern and northeastern parts of the county. Most of the moisture falling on them has been forced to seek outlet through downward seepage, removing clay and the more readily soluble salts from the surface layers and depositing them in the subsoils. Continued downward translocation of material from the upper soil layers is responsible for the development of extremely dense, claypanlike upper subsoil layers and comparatively thin topsoils which are characteristic of all soils belonging to the group. The upper subsoil layers are almost impenetrable to water and are apparently penetrated with considerable difficulty by crop roots. The subsoils are thickest and the topsoils are thinnest in places where surface drainage has been most restricted.

Obviously the agricultural value of any particular soil in this group depends largely on the thickness of its topsoil, or that part of the soil lying above the claypan. Shallow-rooted early-maturing crops, such as small grains, naturally do better than corn, because they mature before the limited moisture supply stored in the topsoils during the winter and early spring is exhausted. Winter wheat gives the largest returns and about 70 per cent of the area occupied by the soils of this group is used for the production of wheat. The rest of the land is used for corn, oats, alfalfa, and natural pasture or hay, ranking in acreage in about the order named. Corn is grown chiefly on those soils in which the claypan lies deepest, and natural pasture and hay land is in the deeper and more poorly drained depressions where the claypan is nearest the surface of the ground. The extremely poorly drained soils are the least extensive, and they occupy only a small part of the farms on which they occur.

Crete silt loam.—Crete silt loam comprises about 88 per cent of the area occupied by the claypan soils, ranking next to Hastings silt loam both in total area and agricultural importance in Saline County. This soil occurs throughout the uplands in the more nearly level and usually higher-lying situations, and it has developed from gray loess similar to that underlying Hastings silt loam.

Surface drainage is not so well developed as on the Hastings soil, but in most areas the slope is sufficient to prevent an accumulation of surface water, and practically none of the soil remains too wet for cultivation longer than a few days after heavy rains. Underdrainage is slow.

The topsoil of Crete silt loam is much thicker than that in any of the other soils of the group, being from 16 to 18 inches thick. It is well supplied with organic matter and has high moisture-retaining powers. In fact, this part of the soil is similar in nearly all characteristics to the corresponding part of Hastings silt loam, except that it is slightly thinner. The upper part of the subsoil is brown dense clay from 14 to 18 inches thick. It greatly restricts water and root penetration, and moisture available for cereal crops must be obtained

largely from the topsoil. Comparatively shallow-rooted, early-maturing, and low moisture-requiring crops do better on this soil than crops requiring moisture in larger amounts and for longer periods. The lower subsoil layer, beginning at a depth of about 36 inches, is loose light-gray silt containing an abundance of lime, chiefly in the form of small hard concretions.

Practically all of Crete silt loam is cultivated and used for the same crops as are grown on Hastings silt loam, including small grains, corn, alfalfa, and forage crops. The acreage in wheat is considerably larger than that in corn, and the acreage devoted to either wheat or corn is greater than the combined acreage of alfalfa, forage crops, and small grains other than wheat.

This soil is not so well suited to corn in all years as upland soils having no claypan layer in their subsoils. In wet years corn does very well, but in dry years the water stored in the topsoil is insufficient for maximum yields of this crop, and the dense subsoil, although usually well supplied with water, is unable to release its moisture fast enough for the growing corn. Alfalfa roots are able to penetrate the dense clay layer and obtain sufficient moisture from the underlying layers to maintain good alfalfa yields for a few seasons. As in all upland soils, however, alfalfa rapidly depletes the deep-seated moisture, and yields decline after five or six years. Although not particularly suited to corn and alfalfa, Crete silt loam is one of the strongest small-grain soils in the county, as is indicated by its extensive use for wheat.

Crop yields depend largely on the rainfall and the care used in handling the soil. The average yield of wheat over a period of years is about 20 bushels an acre and that of corn about 25 bushels. Oats yield about the same as corn and alfalfa yields from 1 to 1½ tons.

Butler silt loam.—Butler silt loam ranks next in area to Crete silt loam among the soils with claypan subsoils. It occupies the shallower basinlike depressions throughout the more nearly level uplands. One of the largest bodies, comprising about 200 acres, is southwest of De Witt in the southeastern part of the county. The total area of Butler silt loam is small in comparison to that of Crete silt loam. It is not so productive in all years as the Crete soil on account of its less favorable surface drainage, but it has been subjected to less excess moisture than Fillmore silt loam or Scott silt loam.

The topsoil of Butler silt loam is very mellow, almost black, and from 12 to 16 inches thick. The light-colored leached layer, which occurs in the lower part of the topsoils of Scott silt loam and Fillmore silt loam, occurs in very few places in Butler silt loam. The subsoil consists of two layers. The upper layer is a claypan which is about as dense as the most compact layer in any other soil of the county and is very dark grayish brown or almost black in contrast to the brown claypan in Crete silt loam. The lower layer, below a depth of about 40 inches, is light-gray loose limy silt similar to that underlying the Crete soil.

The topsoil of Butler silt loam is nearly as well adapted to crop production as that of Crete silt loam. It is slightly thinner than the topsoil of Crete silt loam, and, although as granular, seems to have a higher clay content which necessitates more careful management if favorable tilth is to be maintained. The Butler soil can not be cultivated under so wide a range of moisture conditions without

injury as the Crete. This is well demonstrated in fields including both soils. If the fields are cultivated as soon after rains as moisture conditions in those parts occupied by Crete silt loam become favorable, the associated Butler soils invariably puddle, bake, and become cloddy, losing much moisture through evaporation. This moisture loss is very detrimental to crops, especially in dry years, because the topsoil, being thinner, has a lower moisture-storing capacity than that of Crete silt loam. The upper subsoil layers of the two soils are about equally resistant to the upward and downward movement of soil moisture.

Crop yields on Butler silt loam depend chiefly on the amount of moisture stored in the topsoil. The soil is naturally better suited to shallow-rooted and early-maturing crops than to those which require moisture in large amounts throughout the entire summer. About 90 per cent of the soil is used for small grain, chiefly wheat, and the remainder, except small areas in sweetclover or native grasses, is used for corn. Crop yields in normal years are about the same as on Crete silt loam but in unusually wet or dry seasons are more variable. In dry years the wheat yield is from 10 to 15 per cent lower and the corn yield from 25 to 50 per cent lower than yields obtained on the Crete soil. In wet seasons corn yields usually equal those obtained on Crete silt loam, but wheat yields are somewhat lower because the slightly depressed relief favors the accumulation of too much moisture, and wheat has a tendency to make rank vegetative growth at the expense of the grain.

Fillmore silt loam.—Fillmore silt loam occupies small scattered basinlike areas in the uplands. Some of the largest bodies are on the nearly level divide between Turkey and Squaw Creeks. Few of the areas exceed 160 acres in size, and most of them occupy less than 10 acres.

Fillmore silt loam differs from Butler silt loam chiefly in that its topsoil averages a little thinner, in few places exceeding 12 inches in thickness. It has developed in slightly deeper and more poorly drained depressions than the Butler soil but has not been subjected to such an excess of moisture as Scott silt loam.

The topsoil consists of fairly friable heavy silt loam or silty clay loam. Most of it is well supplied with organic matter and is very dark throughout, but it everywhere contains more or less gray silt from which the organic matter has been leached. In a few bodies the gray material is sufficiently abundant, especially in the lower part of the topsoil, to produce a somewhat gray subsurface layer. The subsoil is similar to that of Butler silt loam in its principal characteristics, the upper part being almost black dense clay, and the lower part light-gray limy and friable silt. Some technical differences occur but are of little agricultural importance and are described in the chapter on Soils and Their Interpretation.

Most of the Fillmore silt loam is too poorly drained for crop production and is used for pasture land. A small part, which has been artificially drained, is used for crops, chiefly wheat. The yields are seldom profitable except in seasons of frequent rains because the thin topsoil does not have sufficient water-storing capacity to maintain the crop during protracted droughts.

Scott silt loam.—The most poorly drained and unproductive soil in the county is Scott silt loam. This is also one of the least extensive soils and is, therefore, of little agricultural importance. It occupies only the deeper and usually smaller basins, or "buffalo wallows,"

throughout the uplands. Few of the bodies exceed 20 acres and most of them occupy only a few square rods.

The topsoil, although friable, in few places exceeds 6 or 8 inches in thickness. The upper part is usually well supplied with organic matter and is rather dark, but the lower part is generally more leached and is considerably lighter colored than the overlying material, in places being almost white. The subsoil is steel-gray or bluish-gray heavy clay, from 4 to 6 feet thick, which is very impervious to water and when dry is difficult to penetrate with digging tools. Excessive moisture has removed all traces of lime from both topsoil and subsoil.

Most of the Scott soil is regarded as waste land. The larger bodies are included in farm pastures, but much of the soil occurs in cultivated fields and is neither tilled nor used for pasture on account of its poor drainage.

BOTTOM-LAND SOILS

The soils of this group occupy only about 15 per cent of the area of the county. The group includes the Wabash, Lamoure, Cass, and Sarpy soils, all of which have developed from sediments washed from the uplands and deposited in the flood plains or first bottoms of streams during periods of high water. The surface of the flood plains slopes almost imperceptibly down the valleys and toward the stream channels. It is remarkably smooth except where traversed by old and present stream channels or modified by slight elevations and shallow depressions. Surface drainage is well established. Local areas are subject to overflow from the main streams, but the water drains off rapidly and practically none of the soil is too wet for cultivation. The underlying water table ranges from about 4 to 15 feet beneath the surface of the ground and the lower part of the subsoil is kept well supplied with moisture even in the drier years.

The Lamoure and Wabash soils have developed from the finer stream sediments, chiefly silt and clay, and the Cass and Sarpy soils from sand and gravel. The moist conditions prevailing in the bottom lands have favored rapid vegetal growth and decay and all the soils, except the Sarpy, which has developed from the most recently deposited sands, have dark-colored, in many places almost black, topsoils owing to an abundant content of organic matter.

The bottom-land soils as a whole are the most productive corn and alfalfa soils in the county, and most of the area occupied by them is used for these crops. Alfalfa can be grown as continuously as desired without decreasing the subsoil moisture to the point where yields decline as they do in the uplands under continued alfalfa cropping. Small grains also grow well but usually produce a rank vegetative growth and a rather low grain yield, and, with the exception of barley which occupies a few fields, they are seldom grown on the bottom lands.

Wabash silt loam.—Wabash silt loam is the most extensive bottom-land soil in the county. It occurs in broken or continuous strips of different widths along nearly all the larger streams, the largest developments occurring along Swan and Turkey Creeks. Its surface is nearly level, except where modified by stream channels, but surface drainage is well established and practically none of the soil is too wet for cultivation.

The topsoil is very dark grayish-brown or black friable silt loam, from 18 to 24 inches thick, which is well supplied with organic matter. The subsoil, which continues to an average depth of about 4 feet, is heavy silt loam or silty clay loam only slightly lighter in color than the topsoil. It is moderately compact but has no claypanlike characteristics and is easily penetrated by moisture and roots. Neither the topsoil nor the subsoil contains sufficient lime to noticeably react when dilute hydrochloric acid is applied. However, the soil does not seem to be deficient in lime so far as crop needs are concerned.

Practically all the land except a few narrow forested strips adjacent to the stream channels is under cultivation. Its high organic-matter content, abundant moisture supply, and nearly level surface combine to make it one of the most productive corn and alfalfa soils in the county. Corn occupies about 85 per cent of the soil, and alfalfa is grown on most of the remainder. The average yield of corn over a period of years is about 45 bushels an acre and that of alfalfa about 3½ tons of hay.

Wabash very fine sandy loam.—Wabash very fine sandy loam differs from Wabash silt loam only in the slightly higher sand content of its topsoil, but this textural difference is scarcely noticeable, except by close observation, and does not seem to cause any differences in the producing powers or crop adaptabilities of the two soils.

Wabash very fine sandy loam is less extensive than Wabash silt loam, and it occurs in narrow strips and small bodies along most of the larger streams in the county. The most continuous strip is along Turkey Creek west of Pleasant Hill. The soil is fairly uniform throughout the area of its occurrence in the county, although much of that along Turkey Creek contains more very fine sand in the subsoil than is typical of the soil as a whole. A few small bodies east of Wilber also have unusually sandy subsoils. The sand, however, is nowhere sufficient to make the soil droughty or to noticeably alter its producing power.

Practically all the land is under cultivation to the same crops as are grown on Wabash silt loam, and crop yields are about the same as those obtained on that soil.

Lamoure silt loam.—Lamoure silt loam occupies a few small bodies in the Big Blue River and Swan Creek bottom lands, one of the largest, comprising about 160 acres, occurring between Wilber and De Witt on the west side of Big Blue River.

Most of this soil lies a few inches below the general level of Wabash silt loam and is not quite so well drained as that soil. Alkali, in sufficient quantities to injure tame hay and grain crops, is present in small spots, but about 95 per cent of the soil is sufficiently well drained and free from alkali for grain and hay production.

The topsoil consists of almost black heavy silt loam containing an abundance of organic matter, and it averages about 20 inches thick. It has a slightly higher clay content than the topsoil of Wabash silt loam and can not be cultivated under quite so wide a range of moisture conditions as that soil. If plowed when wet it has a tendency to form clods, but these break down readily under subsequent tillage and the soil is easily maintained in good tilth. The subsoil ranges in color from light gray to almost black but in most places is gray or mottled gray and brown. It ranges from heavy silt loam to silty clay loam, but it is not compact and is easily penetrated by roots and moisture.

The material is very limy, much of the lime, especially in the areas with lighter-colored subsoils, occurring in small hard or soft concretions and in irregular-shaped spots and splotches.

This soil differs from Wabash silt loam chiefly in the slightly heavier texture of its topsoil and in the higher lime content of its subsoil. It is used for the same crops as Wabash silt loam and has about the same producing power, but, owing to its small extent, it is of little agricultural importance in Saline County.

Included with Lamoure silt loam on the accompanying map is an area of soil about 1½ miles south of Wilber in which the subsoil, between depths of about 14 and 36 inches, is extremely compact black clay. This area occupies about 300 acres and were it more extensive would have been shown on the map as a claypan phase of Lamoure silt loam. Practically all of it is under cultivation to corn or alfalfa, but, according to reports of farmers, the yields average considerably below those obtained on the adjoining bottom-land soils, especially in dry years.

Lamoure very fine sandy loam.—Lamoure very fine sandy loam occupies a few small areas in the Big Blue River bottom lands. The largest area, including about 200 acres, is on the west side of the river south of Wilber.

This soil is similar to Lamoure silt loam in all characteristics except the texture of its topsoil which contains a small amount of very fine sand mixed with the silt. The sand is not sufficiently abundant to reduce the stability or water-holding capacity of the soil, but does make it a little easier to handle than Lamoure silt loam.

Practically all the soil is well drained and under cultivation. It is used for the same crops as other Lamoure soils and Wabash soils and has about the same producing power. It occupies only a small part of the farms on which it occurs and is of minor importance in the agriculture of the county.

Cass very fine sandy loam.—Cass very fine sandy loam occupies narrow strips and small bodies, usually adjacent to the channels, along a few of the larger streams in the county. The strips are most continuous along Turkey Creek, but few of them are more than 15 rods in width, and the total area of the soil in the county is only 8.1 square miles.

Cass very fine sandy loam has developed from stream deposits, consisting largely of gray very fine sand, which have been stationary long enough to have accumulated an abundance of organic matter in the upper layers. The surface is nearly level, and drainage is adequate for cultivated crops in most places.

The topsoil is very dark grayish-brown friable very fine sandy loam from 8 to 12 inches thick. It is similar to the corresponding layer in the Wabash and Lamoure soils but is thinner and more sandy. The subsoil is composed of loose gray or grayish-brown fine sand or medium sand which in most places becomes coarser with depth, and in many places the material is gravelly below a depth of 3 feet. The subsoil may or may not be limy, but in most places it contains sufficient lime, especially in the upper part, to effervesce weakly when acid is applied.

About 75 per cent of this soil is cultivated and the remainder, including the more poorly drained parts and those on which the natural forest interferes with cultivation, is used largely for pasture land.

About half the cultivated land is used for corn and most of the remainder for alfalfa.

The soil is fairly uniform throughout the area of its occurrence, but numerous bodies of Cass fine sandy loam and Cass sandy loam, too small to be shown accurately on a map of the scale used in this survey, are included with Cass very fine sandy loam on the soil map.

Cass very fine sandy loam ranks among the most productive corn and alfalfa soils in the county. Yields of these crops average a trifle lower than on the Lamoure and Wabash soils but are greater than those obtained on any of the upland and terrace soils. Small grains yield no higher on this soil than on the finer-textured soils of the bottom lands, and they are seldom grown.

Cass very fine sandy loam can be cultivated under almost any moisture conditions without injury and with less power and lighter machinery than the more silty bottom-land soils. It is of little agricultural importance in Saline County on account of its small extent.

Cass silt loam.—Cass silt loam differs from Cass very fine sandy loam only in the finer texture of its surface soil, this layer being silt loam instead of very fine sandy loam. This soil occupies 320 acres in the county, the largest area being along Turkey Creek south of De Witt. About half the land is under cultivation, and the remainder is covered by natural forest and is used for pasture land. Practically all the cultivated area is being used for corn and alfalfa, both of which appear to do as well as on Cass very fine sandy loam.

Sarpy very fine sandy loam.—Sarpy very fine sandy loam occupies a few small bodies adjacent to Turkey Creek and Big Blue River. The soil consists largely of incoherent gray sand which has accumulated very little organic matter. In fact, most of the soil, as mapped in Saline County, resembles river wash except that it is a little more stable and supports a sparse grass covering. All the land is in pasture.

SOILS AND THEIR INTERPRETATION

Saline County is in the tall-grass prairie region of the United States. Tree growth occurs only in narrow strips along the major streams and has not noticeably influenced the character of any soil. The mean annual temperature of the county is about 50° F., and the average annual precipitation is about 28 inches. The annual decay of grass roots under the moderate climatic conditions has produced large amounts of black well-decomposed organic matter and all the soils, except those on steep hillsides or on recently deposited light-colored stream sediments, have dark-colored topsoils. The more extensive soils of the county also have granular topsoils and friable or moderately compact nutlike, or cloddy, subsoils with zones of lime enrichment. In addition, the topsoils and subsoils in all except the flood-plain soils have developed layers, or horizons, which differ from one another in one or more important characteristics, such as color, lime content, texture, structure, or compaction.

The characteristics mentioned are not everywhere equally expressed. They are the result of the climate and vegetation under which the soils have developed and are typically expressed only in those soils which have received the full impress of their climatic and vegetative environment. Such soils occupy the well-drained though uneroded parts of the county where conditions have been most favorable for

prolonged undisturbed weathering, and where the soil-forming processes have acted to their full capacity as governed by their environment. The soils, therefore, have reached a stage of development which is normal for the existing climate and vegetation and are regarded as fully developed.

Although the characteristics resulting from the climate and vegetation are typically expressed only in the fully developed or normal soils, they occur in varying degrees of development in nearly all the soils of the county, the stage of development attained by the soils depending on the surface relief, drainage, character of the parent soil materials, and the length of time these materials have been subjected to undisturbed weathering.

In the early stages of soil development, the parent materials were everywhere the controlling factors in determining the character of the soils. As time went on, the processes of soil formation gradually altered the upper part of the parent materials to a degree depending on the surface relief and drainage conditions under which the processes were forced to act, the length of time they acted, and the relative resistance of the parent materials to their action.

Soils in which one or more of the features common to fully developed soils are either absent, poorly expressed, or excessively expressed are regarded as imperfectly developed. The soils of Saline County, therefore, may be divided into two broad groups, namely, fully developed, or normal, soils and imperfectly developed soils.

The normal soils of Saline County occur throughout the uneroded and well-drained parts of the uplands and are also extensively developed on the terraces. Surface relief and drainage conditions have especially favored deep soil weathering, so that nearly all the characteristics common to the parent geologic materials have either been obliterated or so completely altered by the soil-forming processes that they are scarcely noticeable in the soils, and the identifying soil characteristics are almost entirely the result of the climatic and vegetative environment under which the soils have developed.

The following description of a soil profile examined 3 miles east of Friend is typical of all normally developed soils in Saline County: A_1, from 0 to three-fourths inch, dark grayish-brown structureless, friable silt loam. A_2, from three-fourths inch to 3 inches, almost black laminated or platy silt loam in which the laminae are thin and fragile. A_3, from 3 to 22 inches, very dark grayish-brown friable, granular silt loam. The granules are irregular and angular in shape, ranging from one-sixteenth to slightly more than one-eighth inch in diameter. The larger granules are in the lower part of the layer. B_1, from 22 to 36 inches, grayish-brown granular silty clay loam in which the granules are angular and range from one-eighth to one-fourth inch in diameter. The material in this layer is more compact than that in any other layer of the solum but is not claypanlike and is easily crushed in either a moist or dry condition by slight pressure between the finger and thumb. B_2, from 36 to 53 inches, light grayish-brown friable silt loam. The material in this layer is columnar but otherwise structureless. The columns range from 4 to 5 inches in diameter, have numerous horizontal seams and cracks at irregular intervals, and break naturally into soft angular clods of different sizes and shapes. The material does not react to tests for lime. B_3, from 53 to 70 inches, very light grayish-brown floury more or less columnar

silt, in which lime is abundant, occurring in scattered soft or semihard concretions from one-eighth to one-fourth inch in diameter and in finely divided form mixed with the silt. The maximum lime concentration, as indicated by the vigor of reaction when hydrochloric acid is applied, is confined to the upper 11 inches of this layer. C, from 70 to 144 inches, light-gray or buff floury silt which is columnar but otherwise structureless. This material is the loessial formation from which the soil has weathered, and it remains uniform to the depth observed. The material is calcareous but contains much less lime per unit of volume than the layer above. The lime is in finely disseminated form, and no evidence of concentration or segregation of the carbonates exists.

The color and texture transitions between the horizons and subhorizons are gradual. The structure transition is also gradual except directly above and below the A_2 layer, where it is very abrupt. The upper extremity of lime concentration is sharply defined, but the lower one grades almost imperceptibly into the parent loess.

The upper soil layers are rich in organic matter, which accounts for their dark color, but the distribution and stage of decomposition of the organic constituents is not uniform throughout the soil profile, and the intensity of the dark color differs in different layers. The A_2, or laminated, layer is the darkest, as it contains the largest proportion of thoroughly decomposed carbonaceous material, and in many places it is almost black. Its color remains constant when the soil material is pulverized, indicating that the organic matter is thoroughly mixed with the mineral soil particles. The A_1 layer also contains an abundance of uniformly distributed organic material, but not all of this material is thoroughly decomposed and the color of the layer is somewhat lighter than that of the A_2 layer. In the A_3 layer decomposition of the plant remains is complete, but the organic matter is not sufficiently abundant to thoroughly permeate the soil material and occurs largely as a film or coating on the surfaces of the granules. The granular film is thickest in the upper part of the layer making a natural exposure of this part of the layer appear as dark as the material in the layer above, but when the granules are pulverized the resulting material assumes a lighter color, indicating a lower percentage of organic matter than occurs in the A_2 layer. The organic film decreases in thickness with depth, but is still sufficiently thick in the upper subsoil layer to produce the brown color so characteristic of the B_1 layer, but it practically disappears in the lower subsoil layer. The slight compaction occurring in the B_1 layer is caused by the downward translocation of the finer-textured topsoil particles through the agency of percolating waters.

The soil contains worm casts and borings in all layers beneath the A_1 layer, the casts usually being most abundant in the laminated layer and the borings more numerous in the layer of maximum compaction. The worm casts are spherical, about one-sixteenth inch in diameter, and most of them are grouped in rounded clusters including from 10 to 25 individuals, but in places they occur as fillings in old root and insect cavities. The borings are crooked rodlike forms about one-fourth inch in diameter and of different lengths. They also occur as fillings in root, worm, or insect cavities and may at one time have consisted largely of worm casts, but if so, the casts in most places have become obscure, and the material comprising them has become

blended into a uniform mass. The borings and casts are usually lighter or darker than the general color of the layer in which they occur, depending on whether the material composing them was derived from underlying or overlying layers.

The particular soil described is Hastings silt loam, but the description applies also to Hall silt loam. Both soils have developed from a gray silty formation known to geologists as Peorian loess. These soils differ only in topographic position, Hastings silt loam occurring on the uplands and Hall silt loam occupying terrace or bench positions along the streams.

The slope phase of Hastings silt loam and Nuckolls silt loam may, in a broad classification, also be included in the normally developed soil group. The first-named soil throughout most of its area is identical with Hastings silt loam except that it occupies sloping positions. The slope phase of Hastings silt loam and Nuckolls silt loam both have less even surface relief than Hastings silt loam and have been subjected to more erosion which in a few spots has entirely removed the topsoil.

Over most of the slope phase of Hastings silt loam and Nuckolls silt loam erosion has only slightly thinned the topsoils without reducing the number of soil layers or changing the character of the material composing them. In fact, Hastings silt loam and its slope phase are separated on the soil map more on the basis of physiographic differences than on account of any pronounced difference in their soil profiles.

Nuckolls silt loam is separated from Hastings silt loam chiefly on account of color difference. The Nuckolls soil has developed from the Loveland phase of loess, a pale-red slightly sandy silt which underlies the gray Peorian loess of the uplands, and which is thought to be older and more oxidized. The Nuckolls soil in most places has a fully developed profile similar in character to that of Hastings silt loam except for a decided red cast in the B and C horizons.

The soils of the imperfectly developed group have not received the full impress of the regional climate and vegetation. One or more of the characteristics common to normally developed soils is excessively developed, poorly developed, or absent. Normal soil development has been prevented by insufficient time, the resistant character of the parent soil materials to weathering, alkali, poor drainage, or erosion. All soils of the imperfectly developed group, however, have made some progress toward normal development, the degree depending on the relative resistance of the factors mentioned.

For convenience in description the imperfectly developed soil group may be separated into subgroups on the basis of the factor or group of factors instrumental in preventing normal soil development. In the first subgroup may be placed those soils in which normal development has been prevented chiefly by insufficient time. This subgroup includes the Waukesha and Carrington soils, both of which are deeply weathered. These soils differ from Hastings silt loam chiefly in that they have no zone of carbonate accumulation in the solum, and there are a few other differences. The Carrington soils have weathered from glacial deposits, and they contain some sand and gravel. They occupy a little less even land surfaces than Hastings silt loam and have slightly thinner topsoils. The Waukesha soils occupy nearly level though well-drained terraces lying considerably

below the general level of Hastings silt loam. Aside from these differences there are minor differences in the texture of the topsoils, as in addition to the silt loams the Waukesha includes a very fine sandy loam soil and the Carrington, a loam.

The topographic and drainage conditions throughout the Waukesha and Carrington soils, except locally on the steeper hillsides in the Carrington soil areas, are favorable to normal soil development. Moreover, the materials from which these soils have weathered have offered no special resistance to the formation of soil. Part of the more resistant gravel and sand originally present in the drift occurs in the Carrington soils but comprises a very small percentage of the soil mass.

Although the environment under which the Waukesha and Carrington soils have formed is favorable to normal soil development, the absence of a zone of carbonate enrichment in the solum indicates that these soils have not lain in their present position long enough to have received the full impress of their climatic and vegetative environment. The soils, therefore, must be regarded as immature throughout their occurrence in Saline County. They are considered as being normally developed throughout their occurrence in more eastern counties of Nebraska and in Iowa where the absence of a zone of lime enrichment is due to increased precipitation and soil leaching and not to insufficient soil weathering.

The Lamoure, Wabash, Cass, and Sarpy soils of the first bottoms or flood plains in Saline County also belong in the subgroup of imperfectly developed soils in which normal development has been prevented chiefly by insufficient time. Poor drainage has also been a contributing factor in retarding soil development, but its influence at the present time is confined almost entirely to the lower part of the soil profiles.

The flood-plain soils have developed from sediments carried down by the streams from the adjoining uplands and deposited during periods of overflow on the stream bottoms. Subsequent intrenchment of the channels has left the sediments above overflow in nearly all places, but the underlying water level is within a few feet of the surface of the ground, especially during high stages of the streams.

The moist conditions prevailing in the flood plains have especially favored vegetative growth and decay and all the sediments, except the more recently deposited and lightest-colored ones, have dark surface layers. However, sufficient time has not elapsed for the development of horizons having true soil character.

The lower parts of the deposits have remained too wet in most places for thorough aeration and oxidation and the dark upper parts usually rest directly on the unweathered or only slightly weathered alluvial deposits. The character of the sediments, therefore, is the controlling factor in determining the character of the flood-plain soils.

Those soils which have developed from fine-textured sediments, largely silt and clay, are classed with the Lamoure and Wabash soils. They have friable almost black topsoils from 12 to 14 inches thick. The subsoils are moderately compact owing to a rather high clay content. The Wabash subsoils are usually similar to the topsoils in color or are slightly darker, and they are low in lime. The subsoils in the Lamoure soils are black, light grayish brown, grayish brown, or mottled gray and white, and they contain an abundance of lime

in concretionary or disseminated form. Both the Lamoure and Wabash soils have more or less granular topsoils but the subsoils, except locally where the water table is very low, are practically structureless.

Those soils which have developed from the coarser-textured flood-plain sediments, sand or gravel, are classed with the Cass and Sarpy soils. The Cass soils have accumulated considerable organic matter. Their topsoils are as dark and usually as thick as those of the Lamoure and Wabash soils. The Sarpy soils have developed on the most recently deposited sandy sediments and are poorly supplied with organic matter, their topsoils being very thin and light in color.

The subsoils of both the Cass and Sarpy soils are composed largely of loose gray sand and gravel, the gravel in most places becoming more abundant with depth. The Cass and Sarpy soils may or may not contain lime, but if they do the carbonates are in finely divided form and evenly distributed throughout the soil profile.

The second subgroup of imperfectly developed soils in Saline County includes only one soil, Shelby loamy sand, which occurs in a few small areas on valley slopes. This soil has weathered from glacial sand and gravel, and normal development has been prevented largely by the resistant character of the parent materials to weathering and also, to some extent, by erosion. The topsoil is dark, but in few places is it more than 6 or 8 inches thick. It is composed largely of loose rather incoherent sand. The subsoil is a gray or grayish-brown heterogeneous mass of sand, gravel, and clay, chiefly sand. The soil has developed practically no horizons or layers. Lime occurs in many places below a depth of 4 or 5 feet and in some places much nearer the surface of the ground. The lime is uniformly distributed throughout the soil mass, no evidence of a segregation of the carbonates occurring in any part of the solum. The soil is simply glacial drift which has been exposed to weathering barely long enough to have developed a dark color in the topmost few inches of the surface soil.

The third subgroup of imperfectly developed soils includes those in which normal soil development has been prevented largely by imperfect drainage. It includes the Crete, Butler, Fillmore, and Scott silt loams. An excess of mineral salts, probably those of sodium, may also have been a contributing factor in preventing normal development in these soils. The parent loess from which they have developed is not unusually rich in sodium salts and the soils at present are not saline; moreover, no analytical data which would prove that they have been subjected to excessive amounts of alkali are available; nevertheless, some of the characteristics common to these soils are comparable to those in soils which have developed in similar climatic and vegetative environments but under alkali conditions.

Crete silt loam occupies nearly level, although in few places depressed, situations throughout the uplands, and Butler, Fillmore, and Scott silt loams occupy shallow basinlike depressions similarly located. These soils, in the order named, have developed under increasingly poor drainage conditions, and their characteristics seem to be directly related to their moisture environment. Crete silt loam, although more poorly drained as a whole than the Hastings and Hall

soils, has been less affected by excess moisture than the Butler, Fillmore, or Scott silt loams. Its surface, although nearly level, slopes sufficiently to slowly remove the surplus surface moisture, and the soil does not become water-logged even after heavy rains. This soil appears to be nearly normal in its development, differing from Hastings silt loam chiefly in the higher clay content and greater compaction of its upper subsoil layer. It also differs from Hastings silt loam in a few minor characteristics.

The following description of a profile observed about 4 miles east of Dorchester is typical of Crete silt loam in Saline County: A_1, from 0 to one-half inch, dark grayish-brown single-grained friable silt loam. A_2, from one-half to 4 inches, nearly black laminated silt loam, in which the laminae are fragile. A_3, from 4 to 20 inches, very dark grayish-brown heavy friable granular silt loam. The granules are irregularly angular in shape and from one-sixteenth to about one-eighth inch in diameter. The larger granules are near the base of the layer and their surfaces are lightly sprinkled with scarcely visible gray particles, probably consisting of silt. B_1, from 20 to 40 inches, brown dense clay, the intensity of coloring decreasing slightly with depth. The structural units are more or less prismatic with the vertical axis the longer, ranging from one-fourth to one-half inch. The material when dry crushes with difficulty between thumb and finger. B_2, from 40 to 60 inches, yellowish-gray loose loesslike silt, faintly columnar but otherwise structureless. The material in this layer is very calcareous, the lime occurring chiefly in concretions and soft segregations, although some disseminated lime is present. C_1, from 60 to 72 inches, yellowish-gray or buff slightly calcareous loess, in which the lime is disseminated. C_2 from 72 to 96 inches, similar to C_1 except that the material contains no lime.

The content and distribution of organic matter in Crete silt loam appear to be about the same as in Hastings silt loam. The light-colored sprinkling in the lower part of the A_3 layer, however, is more pronounced than in Hastings silt loam, indicating that the Crete soil has been subjected to a little more leaching.

The dense clay in the B_1 layer has probably been formed largely in the same manner as the moderately compact corresponding layer in Hastings silt loam; that is, by the downward translocation of the finer-textured topsoil particles and the concentration of these particles in the B_1 layer. This layer in the Crete soil, however, is much less granular and more dense and cemented than the corresponding layer in comparable topographic situations throughout the Hastings and Hall soils of the county. It is even less granular and appears denser and more cemented than the B_1 layer in areas of prairie soils developed on comparable topography in more eastern counties of Nebraska and in Iowa where the rainfall is greater than in Saline County and the downward translocation of surface soil particles should be more pronounced, as in certain areas of the Marshall, Tama, Muscatine, and Grundy soils. It seems doubtful, therefore, that the B_1 layer in the Crete soil of Saline County owes its dense and claypanlike character entirely to the mechanical concentration of clay carried down from overlying layers. It has much the same appearance, so far as density and structure are concerned, as the layers of maximum compaction in small and patchy areas of soils in Nebraska known to have developed under alkali conditions. Whether the claypanlike

layer in Crete silt loam owes its character partly to the cementing action of salts during the process of its development is not known, and until our present postulations, which are based entirely on observations and comparisons of soils in the field, are proved or disproved no definite conclusions concerning the development of this layer can be formed.

The remaining soils of this subgroup occupy basinlike depressions, locally known as "buffalo wallows" or "lagoons," throughout the more nearly level parts of the loess-covered uplands. Their surface layers contain more leached silt than occurs in the corresponding layer of the Crete soil, and in a few of them this material becomes so abundant in places that it forms a gray or almost white subsurface layer from 2 to 4 inches thick.

The Butler soil has been subjected to more moisture than Crete silt loam but to less than the Fillmore or Scott soils. Few of the depressions in which the Butler soil occurs have drainage outlets, but most of them are not more than a foot or two deep and do not receive surface run-off from as large areas as do the Fillmore and Scott soils. The A horizon much resembles that in Crete silt loam except that it is a few inches thinner and has a more pronounced sprinkling of gray floury silt on the surfaces of the granules in the lower part of the horizon. The B and C horizons are also similar to the corresponding horizons in Crete silt loam except that the upper part of the B_1 layer is darker, probably on account of having received more organic matter through increased downward percolation of water. This layer is almost black in contrast to the decidedly brown color of the corresponding layer in Crete silt loam.

Fillmore silt loam has been subjected during its formation to more moisture than Butler silt loam but less than Scott silt loam. The topsoil ranges from less than 6 to about 10 inches in thickness. It is variable but is usually composed of three layers, each of which is friable. The upper layer is structureless or semigranular, the second layer is laminated, and the third layer is imperfectly granular. None of these layers, however, is persistent, and in a few places the upper subsoil layer may extend to the surface of the ground.

The color of the topsoil ranges from almost black to light gray, the lighter shades being due to the almost white loose floury silt which occurs in greater or less abundance in all places, but which is most concentrated near the base of the topsoil, in many places making that part of the soil almost white.

The B horizon differs from that of Butler silt loam chiefly in that it contains scattered black hard round concretions in the almost black upper part of the horizon. The concretions are from one-sixteenth to slightly more than one-fourth inch in diameter and appear to be composed largely of ferruginous material. The B_1 layer also appears to be slightly denser than the corresponding layer in the Butler soil, but this layer in the Crete, Butler, Fillmore, and Scott soils is everywhere extremely dense, and it is not possible to make any definite statement in regard to its relative density in any of the soils, especially if such a statement is based only on field observations. The C horizon in Fillmore silt loam resembles that in the Crete and Butler soils.

Scott silt loam is the most poorly drained of the upland soils. It occurs only in the deeper basins or parts thereof and has been subjected to a greater excess of moisture for longer periods than either

the Butler or Fillmore soil. Downward percolation has been more continuous and its results more pronounced. Water often stands for several months in the depressions occupied by this soil, and the vegetation in many places consists of rushes and reeds. The subsoil is almost continually saturated and has been thoroughly leached of its carbonates. Such excessive moisture has not been present in the Butler and Fillmore soils of the county, and, although these soils are poorly drained, they have not remained wet long enough for water to penetrate the protective clay layer in sufficient quantity to remove the carbonates from the lower part of the subsoil as in the extremely poorly drained Scott soil.

The topsoil of Scott silt loam does not differ markedly from that of Fillmore silt loam, but it usually contains more of the gray floury silt which gives it a somewhat lighter shade. The A horizon in both the Fillmore and Scott soils, however, is so variable in its characteristics that a comparison of the two soils can not be based on this horizon.

The Scott subsoil is dense structureless clay which extends to a depth ranging from 5 to 6 feet. Excessive moisture keeps the material almost perpetually sticky and plastic, especially the lower part, and has given it a steel-gray or dark bluish-gray color, in many places mottled with rust-brown stains, streaks, and splotches. The clay contains scattered black concretions similar to those occurring in the B_1 layer of Fillmore silt loam. Below the subsoil is light yellowish-gray loose loess which is not calcareous to a depth below 10 feet.

Scott silt loam differs from Fillmore silt loam, which soil it most closely resembles, in the lighter and more mottled color of its subsoil and in the absence of a zone of lime enrichment in the solum.

SUMMARY

Saline County is in southeastern Nebraska. It is approximately 24 miles square and comprises 573 square miles.

The county is part of a gently eastward-sloping plain which was formerly smooth and mantled with loess. In the northern part the old loessial mantle has been only slightly modified by erosion, and the land surface, except where cut by a few shallow east-west stream valleys, is nearly level or gently undulating. In the southern and eastern parts erosion has been more severe and the greater part of the land is strongly rolling or hilly. About 85 per cent of the county is upland, and the remainder includes the alluvial lands which occupy broad shallow valleys along the larger streams.

The average elevation of the county is about 1,400 feet above sea level. Drainage is effected chiefly through Big Blue River which extends north and south near the eastern edge of the county.

Saline County was established in 1855; the first permanent settlement was made in 1858; and the county was organized in 1867. The early settlers came largely from the East-Central States. According to the 1930 census the population of the county is 16,356. Wilber, the county seat, has 1,352 inhabitants, and Crete, the largest town has a population of 2,865.

The county is well supplied with railroads and is crossed in several directions by graveled highways. All parts are supplied with rural

mail delivery; telephones are in common use; and the public-school system is highly developed.

The climate is well suited to the growing of hay crops, vegetables, and grain and the raising of livestock. The mean annual temperature is 50.8° F., and the mean annual precipitation is 27.99 inches. The average length of the frost-free season is 164 days which is ample for the maturing of all crops commonly grown.

Corn and winter wheat are the most important crops, corn usually exceeding wheat in acreage. These crops are followed by oats, alfalfa, wild hay, sweetclover, barley, timothy and clover mixed, potatoes, and rye, which during most years rank in acreage in about the order named.

The soils as a whole are naturally productive. On the basis of soil characteristics and other features which affect agriculture, they are separated into three broad groups, namely, upland and terrace soils with friable subsoils, upland soils with claypan subsoils, and bottom-land soils.

The soils classed with the first-named group occupy about 62 per cent of the area of the county and occur in all parts except in some of the more nearly level parts of the uplands, in upland depressions, and in the first bottoms. The group includes eight soil types and one soil phase. The Hall and Waukesha soils occur on stream terraces, and the remaining members of the group occupy upland positions. All the soils of this group are well drained and are friable throughout. With the exception of Shelby loamy sand, which is somewhat droughty, they have high moisture-storing powers and are well adapted to all crops commonly grown in the region. They are used chiefly for corn.

Hastings silt loam is the most extensive and agriculturally important soil in the county. The Carrington, Shelby, and Nuckolls soils, and the slope phase of Hastings silt loam occupy valley slopes and have been subjected to more or less erosion.

The upland soils with claypan subsoils occupy about 23 per cent of the county. They include the Crete, Butler, Fillmore, and Scott silt loams, all of which occur on the highest and least modified remnants of the old loess plain. Crete silt loam occupies the more nearly level parts of the uplands and is by far the most extensive soil of the group. The Butler, Fillmore, and Scott soils occupy shallow poorly drained depressions. All the soils of this group have extremely dense claypanlike layers in their subsoils.

The utilization of the claypan soils, so far as grain crops are concerned, depends largely on the thickness of the topsoils. The topsoils in the Crete and Butler silt loams are thick enough to store sufficient moisture for shallow-rooted and early-maturing crops, such as small grains, and these soils are used most extensively for wheat. The Fillmore and Scott soils have very thin topsoils and are used chiefly for pasture and hay.

The bottom-land soils occupy about 15 per cent of the county. They occur in the first bottoms or flood plains along the larger streams and include the Wabash, Lamoure, Cass, and Sarpy soils, all of which, except locally, have good surface drainage. The underlying water table occurs at a slight depth, and the subsoils are almost continually moist.

The Wabash, Lamoure, and Cass soils are well supplied with organic matter which, together with their favorable moisture supply, makes them the strongest alfalfa soils in the county, and the greater part of the area occupied by them is used for this crop. Corn is also grown extensively, but small-grain crops are seldom planted in the first bottoms. The Sarpy soils of the bottom lands are poorly supplied with organic matter and are used chiefly for pasture land. They are inextensive.

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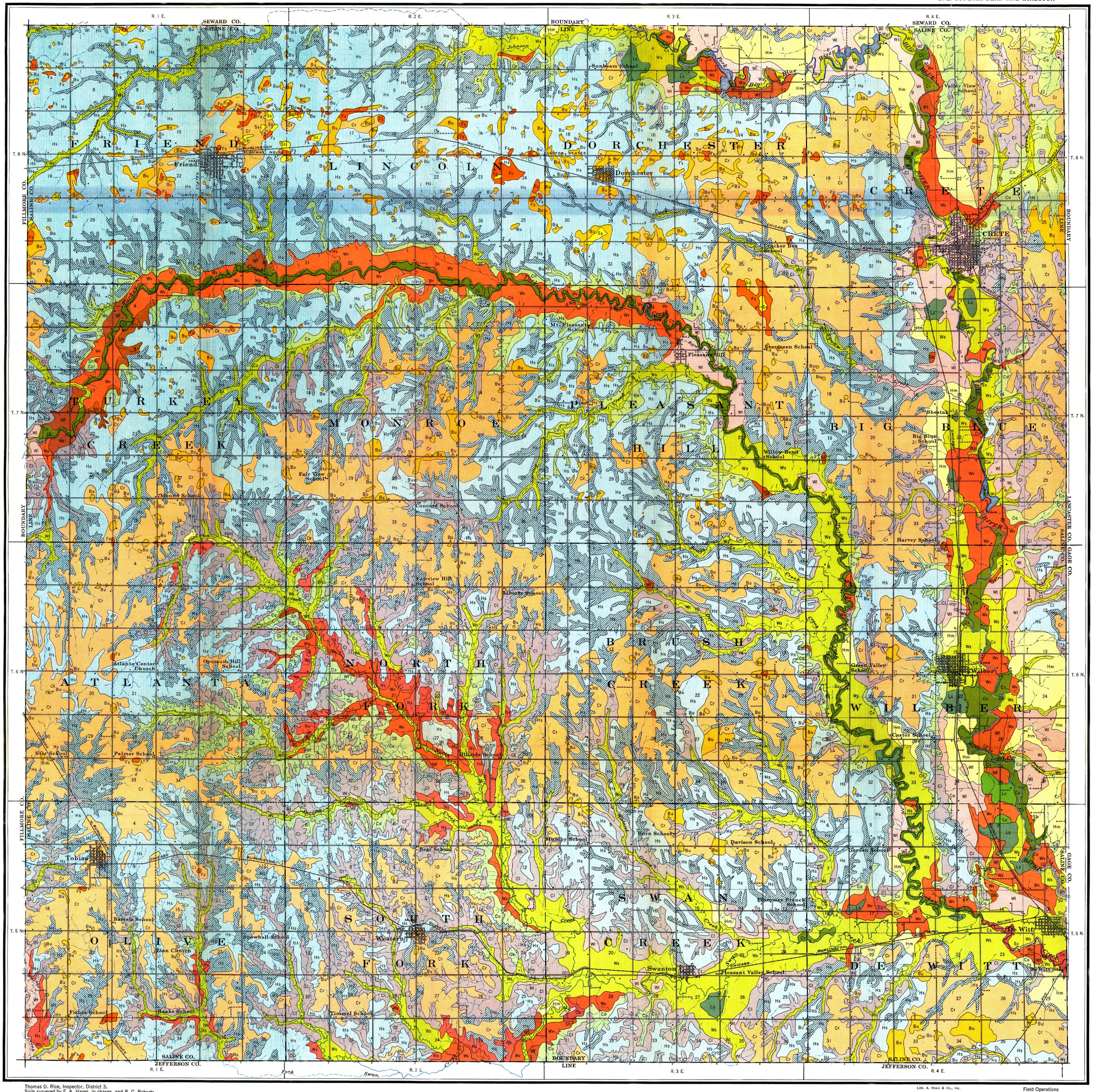
SOIL MAP
SALINE COUNTY
NEBRASKA

UNIVERSITY OF NEBRASKA
STATE SOIL SURVEY DEPARTMENT OF THE
CONSERVATION AND SURVEY DIVISION
G. E. CONDRA, DEAN AND DIRECTOR



LEGEND

Butler silt loam — Bu	Lamoure very fine sandy loam — Lv
Carrington loam — Co	Lamoure silt loam — Ls
Carrington silt loam — Cl	Nuckolls silt loam — Ns
Cass very fine sandy loam — Cv	Sarpy very fine sandy loam — Sv
Cass silt loam — Cs	Scott silt loam — Ss
Crete silt loam — Cr	Shelby loamy sand — Sh
Fillmore silt loam — Fs	Wabash very fine sandy loam — Wv
Hall silt loam — Hm	Wabash silt loam — Ws
Hastings silt loam — Hs	Waukesha very fine sandy loam — Wf
Hs — Slope phase	Waukesha silt loam — Wl

CONVENTIONAL SIGNS

CULTURE
(Printed in black)

- City or Village, Roads, Buildings, Wharves, Jetties, Breakwater, Levee, Lighthouse, Fort.
- Secondary roads and Trails
- Railroads, Steam and Electric (DOUBLE TRACK, SINGLE TRACK, DUPLICATION IN PART)
- Bridges, Ferry (R.R. ABOVE, R.R. BELOW)
- R.R. crossings, Tunnel
- Ford, Dam
- School or Church, Cemeteries (CEM)
- Mine or Quarry, Mine dumps, Made land
- Bluff, Escarpment, Rock outcrop and Triangulation station
- Stony and Gravelly areas
- Soil boundaries
- Boundary lines (STATE, COUNTY)
- Boundary lines (LAND GRANT, CITY OR VILLAGE)
- Boundary lines (CIVIL TOWNSHIP, RESERVATION)
- U.S. township and section lines

DRAINAGE
(Printed in blue)

- Streams
- Lakes, Ponds, Intermittent lakes
- Intermittent streams
- Springs, Canals and Ditches, Flumes
- Swamp, Salt marshes
- Submerged marsh, Tidal flats

The above signs are in current use on the soil maps. Variations from this usage appear in some maps of earlier dates.

Thomas D. Rice, Inspector, District 3.
Soils surveyed by F. A. Hayes, in charge, and R. C. Roberts,
U. S. Department of Agriculture, and E. A. Nieschmidt,
Nebraska Soil Survey.

Scale 1 inch = 1 mile
1 ½ 0 1 2 3 4 Miles

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Field Operations
Bureau of Chemistry and Soils
1928